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Peculiarities of carrier relaxation through high excited states of semimagnetic CdMgTe/CdMnTe heterostructures

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Carrier relaxation under nonresonant optical excitation in a set of quantum wells (QWs) is an important issue because it defines the efficiency of photoluminescence and current processes for different opto-electronic and photonic applications. Typically such a relaxation is characterized by numerous channels which can become dominant under various excitation conditions, applied external fields, temperatures, QW coupling, etc. In this case many specific developments of optical and current gain are expected. Here we present the results of photo- and magnetoluminescence study of uncoupled quantum wells (QWs) Cd1-yMgyTe/Cd1-xMnxTe/Cd1-yMgyTe of diluted magnetic semiconductors grown by molecular beam epitaxy on the semi-insulating substrate GaAs (100). This system is of interest because it allows to realize spin QWs, where confined potential is manipulated by applied magnetic field. Typically the structures were the $Cd_{1-x}Mn_xTe$ QWs (x=0, 0.014, 0.025, 0.05) with different QW widths d_{QW} separated by thick barrier layer $Cd_{1-y}Mg_yTe$ (y=0.2, d_{QW} =30.8 nm).

Low-temperature (T=2K) photo- and magnetoluminescence measurements have been carried out with lasers having different energies of quanta (E_1=1.959 eV, E_2=3.09 eV, and E_3=4.66 eV). It has been revealed that the change of energy of excitation quanta results in a significant redistribution of photoluminescence band intensities related to the quasi-two-dimensional excitons localized in different QWs. Such redistribution could be related to the interference effect, or dependence of transition probability on the quantum well width. However the most reliable mechanism for redistribution through participation of high energy states coupled to QW states is discussed also.